UNITED STATES UTILITY PATENT APPLICATION

OF

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FOR

FACEPLATE BACKINGS AND MONOLITHIC INSERTS FOR GOLF CLUBS

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FACEPLATE BACKINGS AND MONOLITHIC INSERTS FOR GOLF CLUBS

Field of the Invention

[0001] The invention relates to improvements in golf clubs such as a driver, iron or putter.

Background of the Invention

[0002] A large variety of materials have been proposed and in fact used and offered commercially as golf club heads and faces. These materials have commonly been integral or applied as monolithic inserts in the club face in an attempt to achieve more distance and/or more control over the ball. The list of materials includes polymers, ceramics, and metals, typically the most common, stainless steels, BeCu, and lately various titanium alloys, and shape memory materials such as NiTi based and copper based alloys.

[0003] Since the mechanical characteristics (club speed, materials properties, geometry) at the impact of the club face with the ball determine the course (trajectory, distance, dispersion) of the ball; control of the impact response properties can be key to control of the course of the ball. Club head speed and geometry being constant or independent, the specific properties of the material used as the impact surface of the club control the trajectory of the ball.

[0004] It is known that an impact face comprising pixels can improve performance of a golf club. In U.S. Patent No. 5,807,190, various individual elements, referred to as pixels are assembled into an insert for a golf club head striking face. The pixels provide a more uniform response upon impact of a golf ball with a golf club head striking face. This results in less loss of distance on off-center hits and better distance control.

[0005] Modifications to the volume behind the striking face for the purpose of providing certain properties in golf club heads has been addressed in several patents. U.S. Patent No. 5,529,543 discloses a "dead center" club wherein the front face is backed by an open cavity such that the center "sweet spot" is less responsive and thus hits outside the "sweet spot" are said to be similar to on-center hits.

[0006] U.S. Patent No. 6,001,030 discloses a putter head wherein a hard faceplate is attached to a flexible compressible layer comprised of discrete pieces such that the faceplate moves with the compressible layer, and the pieces of the compressible layer have differing hardness and thus compress more or less with harder hits.

[0007] U.S. Patent No. 5,290,036 discloses a vibration damping iron club head wherein a cavity behind the club face is filled with polyurethane and optionally a vibration damping layer.

[0008] U.S. Patent No. 3,817,522 discloses a golf club head with a pressure focusing member comprising a paraboloid metallic element inserted into a cavity in the club face and filled with epoxy. A hollow sphere is situated between the back of the paraboloid insert and back wall of the cavity.

[0009] U.S. Patent No. 6,093,116 discloses a backing and bonding for monolithic face inserts wherein channels are formed in the back of the recess in the club head body. An elastomeric material is poured into these channels for the purpose of binding a monolithic insert to the body and vibration damping. The channels may be deeper near the bottom of the club for added damping of below center impacts.

[0010] There are two primary avenues available to avid golfers desiring to better their score; these are increased skill and improved equipment. The desire for improvements in golf club design and performance is insatiable among enthusiasts. Therefore, there is a need in the art for improvements in club design. The present invention addresses this need.

Summary of the Invention

[0011] By providing a backing design for the striking face of a golf club head, the impact response properties of the striking face may be controlled for example to enlarge or shift the zone of optimum response also known as the "sweet spot".

In a common golf club the size and position of the sweet spot is determined by the material and geometry of club head. Faceplate inserts such as the "pixel" type insert may be used to increase the size of the sweet spot.

[0012] According to the present invention, the performance of a golf club head may be further improved by providing a striking face backing of non-uniform geometry and/or materials. The material and geometric properties of the striking face backing influence the impact response of the striking face. Thus desired effects may be achieved which include enhanced "feel", longer contact time with a struck ball, a more uniform response across the striking face, and a shifted and/or expanded "sweet spot".

[0013] The backings of the present invention may be applied to golf club heads comprising an integral striking face, a monolithic insert, unitary striking face insert or pixel striking face insert. The backings may comprise one or more layers of material, and/or zones comprising elements of different material and/or voids distributed behind all or part of the extent of the striking face. The thickness may be non-uniform, tapering horizontally, vertically, or both being greatest at the periphery or behind an interior portion of the striking face. The backings may comprise elements of the same or different materials of varied geometry distributed within a recess behind the striking face.

Brief Description of the Drawings

[0014] FIG. 1 shows a putter club head incorporating a striking faceplate insert;

[0015] FIGS. 2-9 show various backing arrangements for "pixel" faceplate inserts in cut-away view at line II-II of FIG. 1 wherein the backing is non-uniform in the horizontal direction in accordance with the invention;

[0016] FIGS. 10-14 show various backing arrangements of backings for "pixel" faceplate inserts in cut-away view at line X-X of FIG. 1 wherein the backing is non-uniform in the vertical direction in accordance with the invention;

[0017] FIGS. 15-20 show various monolithic inserts in accordance with the invention wherein the faceplate backing is non-uniform in the horizontal direction according to the invention;

[0018] FIGS. 21-23 show backing arrangements for faceplate inserts wherein the faceplate backing may comprise one or more voids and/or materials which are different from the striking surface material;

[0019] FIG. 24 shows an example of the backing arrangements of the invention incorporated into a club head having an integral striking face;

[0020] FIGS. 25-28 show various monolithic inserts in accordance with the invention wherein the faceplate backing is non-uniform in the vertical direction;

[0021] FIGS. 29-31 show various backing arrangements for faceplate inserts wherein the faceplate may comprise one or more voids and/or materials which are different from the faceplate;

[0022] FIG. 32 shows an iron type golf club head with a "pixel" type faceplate insert;

[0023] FIGS. 33-36 show various backing arrangements for a "pixel" type faceplate in cut-away view at line XXXIII-XXXIII of FIG. 32;

[0024] FIGS. 37-39 show various backing arrangements for a "pixel" type faceplate in cut-away view at line XXXVII-XXXVII of FIG. 32;

[0025] FIG. 40 shows an iron type golf club head with a monolithic faceplate insert;

[0026] FIGS. 41-42 show alternative backing arrangements for a faceplate insert in cut-away view at line XLI-XLI of FIG. 40;

[0027] FIG. 43 shows an iron club head with the faceplate removed to reveal an example arrangement for the faceplate backing illustrated in FIG. 42.

Detailed Description of the Invention

[0028] The present invention provides improvements in the performance of golf clubs through the design of faceplate backings situated behind the impact surface of the striking face. The striking face backings of the present invention

may be implemented in golf club heads comprising an integral striking face, monolithic faceplate inserts (a single piece comprising a striking surface and backing), unitary striking surface faceplate inserts (comprising a single unit striking surface and separate backing element(s)), or a pixel faceplate insert comprising individual striking surface elements as described in U.S. Patent No. 5,807,190 (incorporated herein by reference in its entirety) and separate backing elements.

[0029] The impact response properties across integral faceplates in golf club heads may be controlled by providing faceplate backings according to the present invention. In a golf club head with an integral faceplate, the impact surface is preferably thin metal faceplate backed by a faceplate backing comprising a non-uniform geometry or material property. The impact response of the striking face is influenced by the compression, rebound, and geometry of the faceplate backing in order to achieve a desired property.

[0030] In golf clubs comprising faceplate inserts, the front face of a golf club head includes a recess in which a faceplate insert is retained. The faceplate insert is usually situated in the recess with the front striking surface flush with the front face of the club head body. The club head body may be constructed of any suitable material including various metals, wood, polymers, and composites. The club head body may further comprise features such as perimeter weighting

accomplished by club head shape or inserted weights, sole plates, and the like, as commonly found in golf clubs. The faceplate insert may be retained in the recess by any suitable arrangement such as adhesive bonding or mechanical interfaces between the insert and the club head body.

[0031] A monolithic insert may be constructed of any material suitable for an impact face including metals, polymers, and composite materials. The impact surface may be grooved and otherwise mechanically or chemically treated to provide a suitable texture. A monolithic insert is commonly constructed of a material different from the club head body. A faceplate backing according to the present invention comprises a non-uniform geometry which may be fully in contact with the inner wall of the striking face recess. Alternatively, a backing may enclose voids within the striking face recess, or may be at least partially exposed by an opening in the top, bottom, toe, heel, or back of the club head body such as a through hole from the back of the recess to the back of the club head body. The impact response of the striking surface of a monolithic insert is controlled by the faceplate material and geometry of the faceplate backing to achieve a desired property.

[0032] The monolithic molded polymer inserts commonly found in putters provide a uniform thickness polymeric insert and give a softer "feel" on impact with the golf ball. According to the invention, the geometry and materials of the

insert backings are altered to achieve a more uniform response for off-center hits and improved distance control. Alternatively, the geometry of the back surface of the inserts themselves may be altered. This improvement is achieved by the present invention while retaining the soft "feel" of the polymeric material.

[0033] According to one embodiment of the invention, a unitary striking surface insert comprises a single striking surface element and one or more backing elements. The striking surface element may be comprised of any suitable material for an impact face. Preferably it is relatively thin and flexible so that the properties of the faceplate backing are communicated to the impact surface. The impact surface may be grooved and otherwise mechanically or chemically treated to provide a suitable texture. A faceplate backing according to the present invention comprises non-uniform materials and/or geometries in one or more layers. Materials may include metal, polymers, composite, or combinations of these. Thus, faceplate backings according to the present invention may provide a nearly infinite spectrum of properties which can be used to control the impact response of the striking surface. The backing may be fully in contact with the inner wall of the club head body striking face recess, may enclose voids within the club face recess, or may be at least partially exposed by a second opening in the club head body.

[0034] Faceplate inserts comprised of pixels are known to improve golf club performance by allowing for fine control of the impact response properties across a club face. Pixel elements respond to an impact individually. Thus, the impact response properties of a faceplate insert may be controlled by the selective assembly of a matrix of pixels with desired properties. The impact response of a golf club with a faceplate comprised of pixels can be further improved and controlled by providing a backing for the pixels of varied geometry and/or materials. The backings may be made of a any of suitable materials, and combinations of materials. The backings can be in contact with the back ends of all the pixels in the faceplate. In the backings for unitary faceplates or pixel faceplates, the variety of suitable materials is greater than for the faceplates themselves since abrasion resistance is not a required property. For example, by providing a compressible polyurethane backing to the pixels that is thicker behind the center and thinner, tapered or absent behind the outer areas of the pixel insert the effect is to make club response more uniform than previously achievable.

[0035] Tapering the backing horizontally from the center can provide a gradual transition of response from the center to the edges of the impact zone comprising the insert. The insert backing may be either thicker in the center or thinner in the center depending on materials and desired effect. Varying the thickness of the insert backing vertically behind the pixels of the insert provides a

desired compensation for too high or too low ball impact on the face of the club. Both horizontal and vertical variations in the backing can be combined in a single insert.

[0036] The insert backings can be made of single pieces or assembled from individual elements of the same or different materials combined to comprise the complete backing. The materials of the backing can be metal or polymer or a combination of materials with a very wide range of mechanical properties. Materials of the backing can be of various hardness, durometer, and linear or non-linear stress/strain characteristics, such as exhibited by shape memory metals are known to those skilled in the art. In the case of polymers, injection or transfer molding is often a preferred method to produce complex geometry for the backings.

[0037] Thus, according the present invention, the performance of a golf club may be improved by the incorporation of a faceplate insert comprising a well chosen backing. The "sweet spot" may be expanded, the "feel" experienced by a golfer may be enhanced, and/or the effects of imperfectly executed impacts may be mitigated.

[0038] As illustrated in FIG. 1, a putter club head 1 has a top 4, bottom 5, toe 6, and heel 7. The club head 1 is connected to a shaft 2. The front striking face 3 may be provided with a recess 9 in the vicinity of the impact zone into which an

insert 8, such as a pixel insert may be retained. The insert may also be a single piece or may comprise a striking face as well as backing elements.

[0039] According to the present invention, the impact response of the striking face of the golf club may be finely controlled by designing the geometry and materials of the faceplate backing. FIGS. 2-31 illustrate example embodiments of the invention applied to putter type clubs. The backing is situated between the faceplate and the back wall of the faceplate recess 9. A faceplate insert may be retained by any appropriate mechanical or adhesive arrangement such as a mechanical interface between the edges of the faceplate and the striking face recess, by adhesive bonding of the faceplate to edges of the recess, or adhesive bonding to backing elements which are in turn adhesively bonded to the inner surface of the striking face recess. Among the examples, FIGS. 2-9 illustrate the potential to vary the materials and geometry of the faceplate backing horizontally in faceplate backings preferably for "pixel" type inserts; while, FIGS. 10-14 illustrate the potential to vary the geometry and materials vertically in faceplate backings preferably for "pixel" type inserts. FIGS. 15-31 illustrate additional embodiments of the invention applied to monolithic faceplate inserts, multi-layer inserts, and integral putter faceplates.

[0040] FIG. 2 illustrates a preferred faceplate backing 11 for a pixel type striking face insert 8 in a putter club head body 1 wherein the backing material is

thickest behind the center of the faceplate. The faceplate insert 8 may be comprised of any suitable material, preferably a metal or relatively hard polymer. The faceplate backing 11 may be made of any suitable material, preferably a polymer whose properties are chosen to provide a desired feel and impact response. For example, a compressible polyurethane insert 11 may be chosen to provide a golfer with an enhanced feeling of control by extending the contact time between the ball and the club.

[0041] FIG. 3 illustrates another preferred faceplate backing design 12 wherein the material of the faceplate backing is thicker near the toe and heel of the striking face 3. The faceplate backing 12 may be made, for example, of polymeric material with a high rebound energy to provide a better response to off-center impacts (i.e., a larger "sweet spot").

[0042] FIGS. 4 and 5 illustrate alternative embodiments for faceplate backings 13, 14 wherein the backing comprises stepped zones of thickness. The backing may have a stepped thickness 13 or a extend beneath only a portion of the faceplate 14. A stepped-thickness backing 13 may be comprised of a single material as illustrated or may comprise more than one material such as a front layer and a back layer of different materials or peripheral zones and a central zone of different materials. Furthermore, there may be multiple discrete steps which may not necessarily be symmetrical.

[0043] FIG. 6 illustrates an alternative embodiment of the present invention wherein the backing thickness varies continuously from toe to heel. An asymmetrical insert 15 constructed of highly responsive polymer may be used to compensate for the pushing and pulling of putts off of the intended path which typically result when a ball is struck near the toe or heel of a common putter club. The direction of variation may be reversed in order to shift and extend the "sweet spot" towards the heel of the club.

[0044] FIGS. 7-8 illustrate alternative embodiments of faceplate backing arrangements according to the invention wherein the backing may comprise voids and/or more than one material. The impact response of the faceplate may be further controlled by incorporating additional elements into the faceplate backing. A faceplate backing arrangement may comprise a stepped backing element 16 with additional backing zones 17 which may be voids or may comprise a second material. A stepped faceplate backing element 16 may be combined with voids 17 which may be in outer zones as illustrated in FIG. 7 or may comprise a central zone of second backing layer as shown in FIG. 8. A backing element 18 may be combined with multiple zones 19, 20, 21, 22, 23 of a second layer. In further variations of this embodiment, one or more or the second layer zones 19, 20, 21, 22, 23 may comprise the material of the first layer 18 or a void.

[0045] The response of a pixel faceplate insert 8 may be even more finely controlled by providing a backing arrangement comprising a plurality of backing elements 24, 25, 26, 27, 28, 29, 30, 31 of variable geometry and/or materials as illustrated for example in FIG. 9.

[0046] In accordance with additional examples of the present invention, a backing arrangement for a "pixel" faceplate insert 8 may comprise variations in geometry and/or materials in the vertical direction as illustrated for example in FIGS. 10-14. A faceplate backing 31 may be thicker near the bottom to provide a more even response and less harsh feel for low impacts, or a backing may comprise additional highly responsive lightweight material 32 near the top to shift and expand the "sweet-spot" upward while maintaining a mass distribution near the bottom as may be desired for certain club head designs. A backing 33 of compressible material with the maximum thickness behind the "sweet- spot" 33 allows extended contact between a struck ball and the club face. Backing arrangements 34, 35 may also extend behind a portion of the faceplate to provide a discrete zone of controlled impact response. It should be recognized that, many of the arrangements for varying the geometry or materials of a backing in the horizontal direction shown in FIGS. 2-9 may also be applied in the vertical direction.

[0047] FIGS. 15-20 illustrate example embodiments of monolithic faceplate inserts 41, 42, 43, 44, 45, 46 in a putter club head comprising various non-uniform thickness faceplate backings. Inserts 41, 42, 43 may have a stepped thickness from the toe to heel ends of the insert. Any number of steps may be included, or the thickness may vary continuously 44, 45. Many other geometries may be implemented in a monolithic insert according to the invention, for example the backing may taper toward the toe or heel end of the insert. A material for each embodiment is chosen in combination with the backing geometry to provide the desired properties. For example, a soft material with a low rebound in inserts having backings 42, 43, 44 which are thickest in the center provides a soft "feel" with extended contact between the ball and club face. The same material in a monolithic insert with a backing thickest at the toe and heel give a softer feel in off center hits serves to provide the golfer with tactile feedback as well as reducing the distance of off center hits. A material with a high energy rebound in inserts having backings 42, 43, 44 which are thickest in the center provides a highly reactive sweet spot. The same material in a stepped insert backing which is thickest at the periphery may be chosen to provide a more even reaction in off center hits. A monolithic insert backing 46 incorporating a void 47 may be used to control and enhance the shaped deformation of the faceplate and to provide distinct zones of impact response in a monolithic insert. FIGS. 25-28 show

example vertical variations in monolithic insert backings 70, 71, 72, 73 which may be used individually or in combination with the designs exemplified in FIGS. 15-20.

[0048] FIGS. 21-23 illustrate faceplate inserts comprising a solid faceplate backed by one or more backing elements. For example, as shown in FIG. 21, a faceplate 48, which may be made of relatively hard and semi-rigid material, may be backed by inner 49 and outer 50 zones of different softer material or voids. Alternatively, a faceplate 51 shown in FIG. 22, which may be made of flexible but un-compressible material, may be backed by multiple layers with variable thickness which may be chosen for individual properties. A first backing layer 52 may be chosen for example to absorb vibrations while a second backing layer 53 which is thickest in the center may be chosen to provide a compressible reactive backing with a greater response behind the centroidal sweet spot. A uniform faceplate 54 shown in FIG. 23 may be backed by a plurality of backing elements 55, 56, 57, 58, 59 and/or voids 60 which are arranged to provide zones of response to a faceplate which may be made of uniform flexible material. FIGS. 29-31 show example embodiments having vertical thickness variations in multilayer insert backings with backing layers 75, 76, 78, 79, 80, 82, 83 and voids 84 which may be used individually or in combination with the designs exemplified in FIGS. 21-23.

[0049] As illustrated in FIG. 24, the faceplate backing of the invention may be incorporated into a golf club head with an integral faceplate 61. A golf club head 1 may be cast or machined to have a thin integral faceplate 61 and a slot opening to at least one of the top, bottom, toe or heel. A faceplate backing comprising one or more backing elements 62, 64, 65 and/or voids 63 may be inserted into this slot in order to enhance and control the impact response of the faceplate.

[0050] Faceplate backings in accordance with the invention may be incorporated into iron and driver type clubs as well. FIG. 32 illustrates an iron type club with a recess 109 in the front face 103 with an insert 108 such as a "pixel" type insert. FIGS. 33-39 illustrate example embodiments of faceplate backings which may be utilized with pixel type iron faceplates. As described above for a putter, backings may be more 111 or less 112 thick in the center, or may taper towards the toe or heel. As shown in FIG. 35, a faceplate backing may comprise multiple elements such as a layer which is thicker at the periphery 113 in combination with a layer thickest in the center 115, optionally, a thin element 114 such as a NiTi may lie between such layers to provide "shape memory". A faceplate 108 may be backed by multiple layers 116, 117, 118, 119, each layer may comprising zones of differing material and/or voids.

[0051] FIGS. 37-39 illustrate example embodiments having vertical thickness variations of the backings 121, 122 or multiple backings 123, 125, 126.

[0052] FIG. 40 shows an iron type club with a monolithic insert or unitary faceplate insert 131 in a recess 109 in the front face 103 of the club head 101. FIG. 41 shows a cross section view at line XLI-XLI of FIG. 40 where a monolithic insert 131 encloses voids 132 within the recess 109. It should be apparent from FIGS. 40-41 that the various backing geometries for monolithic inserts illustrated in FIGS. 15-20 and FIGS. 25-28 for putters are applicable to embodiments of the present invention irons and drivers.

[0053] FIG. 42 shows a unitary faceplate insert 137 and faceplate backing 136 which may be inserted into the recess 109 of club head body 101, the zone 135 may be an enclosed void as illustrated or may comprise material different from the faceplate 137.

[0054] FIG. 43 illustrates a view of club head body 101 with the faceplate 137 removed to show an example embodiment of backing 136 in place. It should also be apparent that the backing arrangements for unitary faceplate inserts illustrated in FIGS. 21-23 and FIGS. 29-31 for putters are also applicable to irons and drivers.

[0055] Any of the backing arrangements which are non-uniform in the vertical direction may be horizontally uniform or non-uniform. Likewise, any of the backing arrangements which are non-uniform in the horizontal direction may be vertically uniform or non-uniform in accordance with the invention.

[0056] The foregoing has described the principles, preferred embodiments and modes of operation of the present invention. However, the invention should not be construed as being limited to the particular embodiments discussed. Thus, the above-described embodiments should be regarded as illustrative rather than restrictive, and it should be appreciated that variations may be made in those embodiments by workers skilled in the art without departing from the scope of the present invention as defined by the following claims.